

Torao Takagi\*: **Lodicules of some Japanese bamboos**

高木虎雄\*: 日本産竹類数種の鱗被

Several recent studies (Hubbard 1949; Church 1949; Stebbins 1956 a; Tateoka 1960; Hsu 1963) have revealed the significance of lodicule features in the systematics of the grass family. This character has been enumerated by Stebbins and Grampton (1961) as one of the most important characters, which greatly affects the systematic arrangement of genera into tribes and of tribes into subfamilies. Stebbins (1956 b) published illustrations indicating that in grasses there are four rather distinct types of lodicules: panicoid, chloridoid, festucoid and bambusoid. Subsequent studies (Tateoka 1960, 1961) suggest the presence of some other types, e. g. danthonidoid—arundinoid type. Hsu (1963) has demonstrated that the lodicules of Formosan *Panicum* species are in serial modification as to the degrees of fleshiness, plicature and vascularization, though they are throughout included in the panicoid type. Further detailed investigations on lodicules are apparently needed.

Most species of Bambuseae only rarely flower, so that the materials for the observations on flower proper are difficult to be obtained. The present author has tried to gather flesh materials of bamboo spikelets for the last several years, and the results of the author's studies on the lodicules of some bamboo species are reported in this paper. The species examined are listed in Tab. 1 together with the localities where the materials were collected. The lodicules were stained by a drop of aceto-carmin and were examined under a microscope of  $\times 60$ . Measurements were made by a micrometer.

Tab. 2 shows the results of the present observations. The lodicules of all species examined are three in number, two being found at the margins of the palea at the base and the third one on the abaxial surface of the palea. The latter is usually somewhat smaller than the former. The lodicules are hairy, at least on the upper margin, and are elliptic, narrowly elliptic, oblong or obovate in shape. Several (more than three) vascular traces are throughout found. Bi- or multi-cellular hairs have been observed in two species, *Sinobambusa tootsik* and *Chimonobambusa marmorea* (Figs. 11 and 12). The presence of this kind of hairs on lodicules of grasses seems not to have been reported so far, and further

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Tab. 1. Species examined and their localities.

Species	Locality
<i>Shibataea kumasaca</i> Makino	Saga, Kyoto
<i>Phyllostachys reticulata</i> G. Koch	Saga, Kyoto
<i>Semiarundinaria yashadake</i> Makino	Mt. Kurama, Kyoto
<i>Pleioblastus simoni</i> Nakai	Ikenobe, Miki-machi, Kagawa Pref.
<i>Pseudosasa japonica</i> Makino	Mt. Kurama, Kyoto
<i>Sinobambusa tootsik</i> Makino	Kawakami, Okayama Pref.
<i>Sasamorphia purpurascens</i> Nakai	Hosono, Kitakuwata-gun, Kyoto
<i>Chimonobambusa marmorea</i> Makino	Saga, Kyoto
<i>Arundinaria rhyoncata</i> Koidz.	Mano-mura, Shiga-gun, Shiga Pref.
<i>Sasa nipponica</i> Makino	Mt. Hiei, Kyoto

studies will reveal whether the lodicules with bi- or multi-cellular hairs are confined to bamboos or not.

When the lodicules of bamboos as described above are compared with those of festucoid, panicoid and chloridoid grasses, clear differences are found. The festucoid lodicules lack vascular traces and are almost always glabrous, although they somewhat resemble bamboo lodicules in shape. The panicoid and chloridoid lodicules are characterized by the truncate apex, while bamboo lodicules are more or less pointed or round. Reeder (1962) has noted that the lodicules of centothecoid grasses, such as *Lophatherum* and *Centotheca*, are very similar to those of the chloridoid grasses. Thus, the lodicules of bamboos are different from those of centothecoids in accordance with their differences in embryo anatomy. The lodicules of danthonidoid—arundinoid grasses, which are often hairy, pointed and have vascular traces (cf. Tateoka 1960, 1961), are somewhat similar to those of bamboos, but the bamboo lodicules are clearly larger than those of the danthonidoid—arundinoids. Detailed observations of the lodicules of Oryzeae, Olyreae, Ehrharteae, etc. may be needed before comparing them with the lodicules of Bambuseae.

Among the species examined, *Shibataea kumasaca* is unique in having particularly large lodicules (Fig. 1). According to the generally accepted opinion (Arber 1934), lodicules correspond to the perianth of the inner whorl, and their large size seems to be regarded as a primitive feature. *Shibataea* also retains primitive features in bracts. Takagi (1960) has published illustrations of lodicules

Tab. 2. Features of lodicules in the species examined.

Species examined	Number of lod.	Size (mm) { a * b *	Shape	Number of vascular traces { a * b *	Hair features	Fig.
<i>Shibataea kumasaca</i>	3	{ 5.8-5.9 4.5	obovate	{ 7-8 6	Scanty, along the upper margin; uni-cellular hairs, ca. 0.3 mm long.	1
<i>Phyllostachys reticulata</i>	3	{ 4.8-4.9 2.7	narrowly obovate	{ 4 3	Along the margins; uni-cellular hairs, ca. 0.5 mm long.	3
<i>Semiarundinaria yashadake</i>	3	{ 5.4-5.6 5.1	elliptic, narrowly elliptic or narrowly obovate	{ 7-8 4	Along the margins; uni-cellular hairs, ca. 0.3-1 mm long.	2
<i>Pleioblastus simoni</i>	3	{ 3.9-4.5 3.2	narrowly elliptic or elliptic	{ 10 5	Along the margins; uni-cellular hairs, more than 1 mm long.	4
<i>Pseudosasa japonica</i>	3	{ 4.1-4.2 4.2	elliptic or narrowly elliptic	{ 6 5	Along the margins; uni-cellular hairs, ca. 0.5 mm long.	5
<i>Sinobambusa tootsik</i>	3	{ 2.8 2.7	elliptic or oblong	{ 5-6 5-6	Along the margins; uni- and multi-cellular hairs.	6 & 11
<i>Sasamorpha purpurascens</i>	3	{ 2.6-2.7 2.2	elliptic	{ 7 5	Along the margins and on the upper part; uni-cellular hairs, ca. 0.6 mm long.	8
<i>Chimonobambusa marmorea</i>	3	{ 1.6-1.8 1.6	elliptic	{ 5 3	Along the margins; uni- and multi-cellular hairs.	7 & 12
<i>Arundinaria rhyoncata</i>	3	{ 2.6 2.4	elliptic or oblong	{ 5-8 4	Along the margins and on the upper part; uni-cellular hairs, more than 1 mm long.	9
<i>Sasa nipponica</i>	3	{ 1.8 1.7	elliptic	{ 6 3	Along the margins and on the upper part; uni-cellular hairs, ca. 0.8 mm long.	10

\* The lodicules are three in number in all species examined, and two are found at the margins of the palea at the base and the third one on the abaxial surface of the palea. They are usually somewhat different, and the lodicules indicated by 'a' are those found at the margins of the palea and the third one is indicated by 'b'.

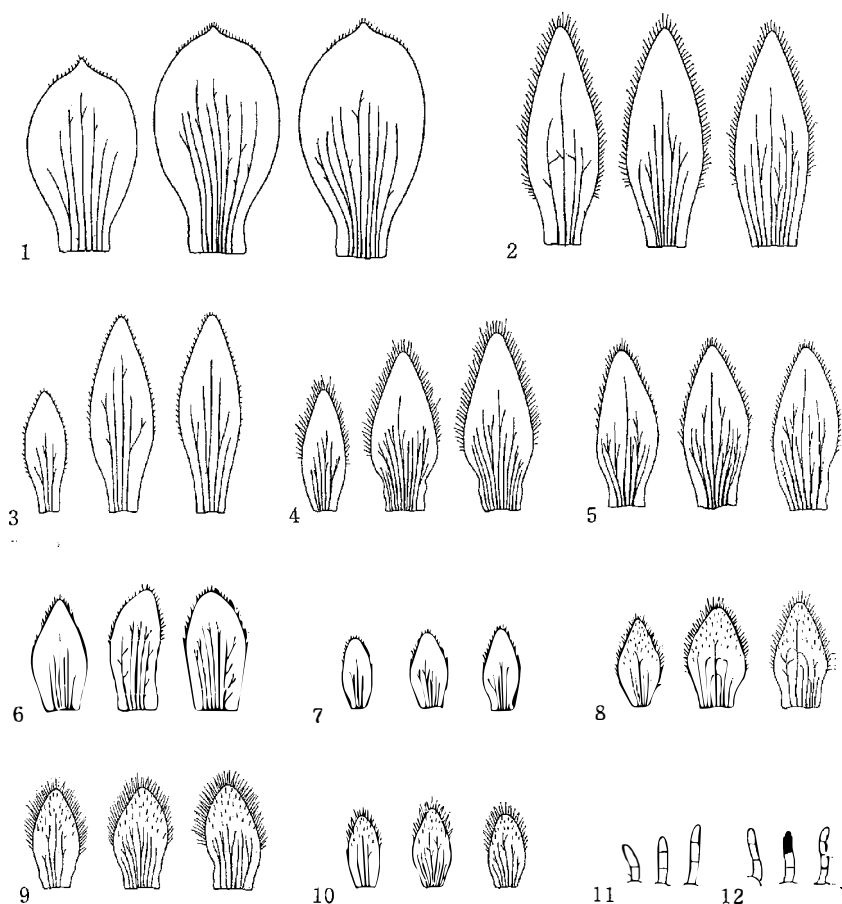


Fig. 1-10. Lodicules.  $\times 5$ . 1. *Shibataea kumasaca*. 2. *Semiarundinaria yashadake*. 3. *Phyllostachys reticulata*. 4. *Pleioblastus simoni*. 5. *Pseudosasa japonica*. 6. *Sinobambusa tootsik*. 7. *Chimonobambusa marmorea*. 8. *Sasamorpha purpurascens*. 9. *Arundinaria rhyoncata*. 10. *Sasa nipponica*. Fig. 11 and 12. Bi- or multi-cellular hairs on the lodicules.  $\times$  ca. 20. 11. *Sinobambusa tootsik*. 12. *Chimonobambusa marmorea*.

of a number of species of *Sasa*, and it is clear that *Sasa* species are similar to one another as to this character. The lodicules of *Phyllostachys* (Fig. 3) and *Semiarundinaria* (Fig. 2) are clearly different from those of *Sasa* (Fig. 10) in shape, size and the hair-feature. The present author believes that lodicules are useful for the systematic arrangement of bamboo species into genera, but it is.

desirable to study the lodicules of many other species before presenting conclusive remarks. As to the classification of the tribe Bambuseae, several different schemes have been proposed. Holttum (1956) has analyzed the ovary structure of bamboos, and has presented a new scheme quite different from the conventional one. Wu (1962) has also recently introduced the anatomical features of leaves into the systematics of the Bambuseae. The present observations are confined to Japanese species, and no information on the lodicules of *Schizostachyum*, *Oxytenanthera*, etc. was available to the present author. It may be interesting to study the classification of the bamboo tribe through a combined use of these new lines of approach.

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#### 摘 要

近年のイネ科の系統分類学において鱗被の特徴が注目されているが、竹笹類に関しては、材料の入手の困難さのために、欧米からもみるべき報告はなされていない。筆者は日本産竹笹類の 10 属 10 種の鱗被を観察したので、その結果をここに報告した。いわゆるタケ型の鱗被の特徴をより明確にするためには、邦産の種類と縁の遠い外国産の属 (*Oxytenanthera*, *Schizostachyum* など) の鱗被を調査する必要がある。また、これまでの観察結果によると、属によって鱗被の特徴が異なるようであるが、これはなお今後の研究によって確かめていきたい。

#### Literature cited

- 1) Arber, A. 1934. The Gramineae: A study of cereal, bamboo and grass. 480 pp. Cambridge Univ. Press.
- 2) Church, G.L. 1949. Amer. Jour. Bot. **36**: 155-165.
- 3) Holttum, R.E. 1956. Phytomorphology **6**: 73-90.
- 4) Hsu, C.C. 1963. Jour. Jap. Bot. **38**: 75-86.
- 5) Hubbard, C.E. 1946. Blumea Suppl. **3**: 10-21.
- 6) Reeder, J. R. 1962. Amer. Jour. Bot. **49**: 639-641.
- 7) Stebbins, G.L. 1956 a. Evolution **10**: 235-246.
- 8) ———. 1956 b. Amer. Jour. Bot. **43**: 890-905.
- 9) ——— and B. Grampton. 1961. Recent Advances in Botany **1**: 133-145.
- 10) Takagi, T. 1960. The Japanese Bambusaceae. pp. 39. Kyoto.
- 11) Tateoka, T. 1960. Canad. Jour. Bot. **38**: 951-967.
- 12) ———. 1961. Bull. Torrey Bot. Club **88**: 143-152.
- 13) Wu, M.C.Y. 1962. Bot. Bull. Acad. Sinica **3**: 83-108.